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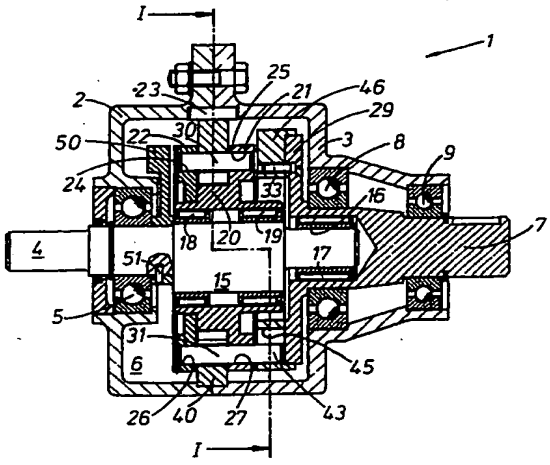

(57) Abstract

A motion transmitting device comprising an eccentrically supported pin carrier which upon rotation of the eccentric orbits gear means. The gear means may be a fixed female or male gear attached to the housing, or a male gear attached to the output drive shaft. The eccentric member (15) is formed integral with the input drive shaft (4). The carrier (20) supports an array of equally spaced pin members (30, 31) which in sequence engage with teeth (41) of the gear means (40). In the case of the female gear type (40), only alternate pins (31) are extended through openings (26, 27) in the carrier (20) to engage with respective apertures (45) in the locating body (46) formed as part of the output drive shaft (7). In the case of the male gear types, alternate pins extend in opposite directions and there is a locating body provided with respective apertures for each set of pins.

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MOTION TRANSMITTING DEVICES

In the art of mechanical speed reduction machinery, it is common to employ either spur or worm type gearing. However, in the case of spur gear drives, when more than two gears trains are required to obtain the required reduction, the unit becomes both costly and bulky, whereas in the case of worm drives, a high operating efficiency is difficult to obtain.

This invention is directed to those other types of mechanical speed reducers better known as planocentric or hypocycloidal types.

Earlier versions of this type of speed reducer have achieved high operating efficiency, but the manufacturing cost is, in speed reduction machines for many applications, prohibitively high.

By far the largest segment of the market in speed reduction machines is for devices in the range of 15:1 to 35:1 ratio. Therefore in order to provide industry with a cheaper and simpler mechanical speed reducer, this invention concerns improvements that may not only overcome certain disadvantages of prior types of planocentric or hypocycloidal speed reducers, but may also reduce the number and complexity of internal component parts. Particular embodiments at least may also allow a number of the internal components to be manufactured from processes such as powder-metallurgy in order to obtain parts which require little or no finish machining.

In particular, this invention is an improvement over four basic prior types of mechanical speed reducers that are currently known. In U.S. Patent No. 4,526,064, the speed reducer disclosed has the unusual feature in that the pins are located between part

ovoid shaped profiles in the gear and stator means, the pins being in loose captive dependency with such guidance means. One of the problems in this type of device, is the difficulties in accurately positioning the pins at the start of the working cycle, as it is most advantageous that the pins transfer effort substantially tangental to the gear means.

U.S. Patent No. 4,031,781 discloses an extremely successful but expensive speed reducer that has become well known in the industry. The device comprises a stationary internal gear and an eccentrically mounted external gear driven by the input shaft. An array of pins fixed in the housing serve as reaction points as the eccentric motion of the external gear engages in sequence with pins for torque transmission. In this type of device, a back-to-center coupling is required to convert the eccentric motion of the external gear with the output shaft of the device.

In U.S. Patent No. 4,429,595 a hypocycloidal device is combined with a pin-plate coupling. One of the disadvantages is the large number of extra parts required in the device to obtain back-to-center motion.

U.S. Patent No. 4,604,916 discloses a speed reducer of the epicyclic type where an array of rollers transmit torque between two first and second sets of specially shaped races. The device requires coupling means to bring the eccentric motion of the epitrochoidal gears back-to-center and this is achieved by the addition of pin-plate coupling comprising three pins supported in a centrally located spider member.

In broad terms, all such prior motion transmitting devices follow the same basic geometry that provides them with the capacity for

high ratio speed reduction in a single step.

Such devices employ two elements, one of which rotates or is fixed concentrically with the shafts and one which gyrates on an eccentric. In this invention, one element is a gear means and the other element carrys a circular array of pins meshing with the gear means sequentially, where one element rotates relative to the other in the ratio:

$$\frac{N}{N-n}$$

where "N" is the number of engagement means (e.g. teeth) in one element, and "n" is the number of engagement means (e.g. pins) in the other element.

From one aspect the invention consists in a motion transmitting device comprising gear means, a carrier having a generally circular array of longitudinal pins mounted thereon such that their axes are fixed with respect to the carrier, the gear means and the carrier being constructed and disposed relative to each other such that relative gyratory movement transverse to the pin axes causes the pins and the gear means to engage and disengage to cause relative rotation of the carrier or gear means, and means for coupling an output shaft to the gear means or pin carrier for rotation of the shaft in response to the relative rotation of the carrier or gear means wherein at least some of the pins extend beyond the carrier and wherein the device further comprises a locating body having apertures for respectively receiving extending portions of the pins and for engaging the portions whilst not restricting the gyratory movement thereof.

In one preferred embodiment, alternate extending pins extend in

opposite directions and there is a respective locating body for each set of pins. In this case, the locating bodies act as a non-rotating reaction member.

In another preferred embodiment, the device may include a locating body which constitutes the coupling means and is rotatable with the output shaft. In this case, the locating body acts as a rotating reaction member.

In a further preferred embodiment, the device may include a locating body which is fixed and the coupling means includes or is constituted by the gear means.

One advantage of at least certain aspects of the invention is that they overcome one of the problems encountered in some prior types of speed reducers where pin position cannot accurately be determined. In such types, there difficulty in accurately positioning the pin with the gear means at the start of the working cycle. This is one of the most critical points in devices of this type as it is the most advantageous that the point of effort acts substantially tangental to the gear means. Therefore, in these aspects of the invention, because the position of the pin may now be accurately determined at all critical periods of the cycle (as the longitudinal axes of the pins remains fixed relative to the carrier), all or just a proportion of these pins can be extended from the carrier to engage with the locating body so causing rotation of the output drive shaft.

The number of pins and the dynamics process by which they operate may be designed according to any of the well known standard arrangements, overlapping pitch circles or not, typically as

taught in Ercoli, French Patent No. 1,349,898.

The invention also makes it possible to modify the profiles of contact engagement for the pins on both the gear means and locating body to reduce the radial loads on the bearings.

The pins may be cylindrical pins which are fixed or journalled in their respective holes in the carrier, so that the longitudinal axes of the pins remain fixed relative to the carrier. Further, pins may be fitted with suitable rollers for engagement with the gear means and/or their respective apertures provided in the locating body.

The carrier for the pins may be caused to gyrate on an eccentric on which it is rotatably mounted. In one example, pins are extended on one side of the carrier to engage with apertures provided in the locating body attached to the high torque shaft. In a further example, every other pin is extended on one side of the carrier to engage with apertures formed in one locating body fixed to a housing wall. The remaining pins are extended to the opposing side of the carrier to engage with apertures formed in another locating body fixed to the other housing wall.

The apertures provided in the locating body can be made circular sized equal to the sum of the pin diameter and twice the eccentricity, but this form may be varied to allow for relief from radial loads.

The shape of a aperture is such to allow the pin to move in an circular orbit within the aperture, thereby driving over an arc of 180 degrees at most and eliminating the gyratory motion of the carrier.

Further, as it is often geometrically impossible to include

apertures for all adjacent pins (as adjacent apertures would intersect each other in the locating body), it is preferred that alternate pins should be extended on the same side of the carrier member to engage with respective apertures in a locating body. The remaining pins can either be of shorter length so as to remain within the carrier, or be extended out of the carrier from the other face to engage with their own respective apertures in further locating body.

The gear means may comprise one of three main types:

a) A female internal gear fixed to the housing of the device.

b) A male external gear fixed to the output drive shaft.

c) A male external gear fixed to the housing of the device.

Preferably the carrier, gear means and the locating body are made from fused powder metal, pressings or plastic material in order to reduce manufacturing cost and thereby provide inherent inexpensive bearing surfaces.

The invention may be performed in various ways and specific embodiments will now be described with reference to the accompanying drawings.

FIG. 1 is a longitudinal section through a motion transmitting device according to the invention.

FIG. 2 is an end view through section I-I of Fig. 1 showing relative positions of pins with the gear means and the apertures.

FIG. 3 is a longitudinal section through an alternative embodiment of a motion transmitting device.

FIG. 4 is an end view through section II-II of Fig. 3 showing relative positions of pins with the gear means and the apertures.

FIG. 5 and FIG. 6 are respective longitudinal sections through

further embodiments of the device.

FIG. 7 is an sectioned end view illustrating a hydraulic gear motor serving the motion transmitting device.

FIG. 8 and FIG 9 are respective longitudinal sections through further embodiments of the device.

A motion transmitting device as shown in FIGS. 1 and 2 is identified by the reference number 1 and includes housing elements 2, 3. An input drive shaft 4 (always the low-torque shaft) is journaled in bearings 5, 17, and an output drive shaft 7 (always the high-torque shaft) is journaled in bearings 8, 9 such that the shafts 4, 7 are coaxial.

The bearings 5, 8, 9 are supported in the housing elements 2, 3 and the two outermost bearings 5, 9 are preferably sealed bearings in order that lubricant such as grease, contained within internal chamber 6, does not escape from the motion transmitting device 1.

The input drive shaft 4 is provided with an eccentric portion 15, and is extended into pocket 16 in the output drive shaft 7, for support by bearing 17.

Bearings 18, 19 are positioned on the eccentric portion 15 of the input shaft 4 so that the carrier 20 can be supported for free rotation about the eccentric portion 15.

The carrier 20 is formed with integral flange like peripheral portion 21, and is attached to a second flange like peripheral portion 22 by screws 28 as shown in FIG. 2. The peripheral portion 22, 21 define respective sets of equally spaced pairs of aligned openings 24, 25 and 26, 27.

The first set of openings 24, 25 receive and support array of

short pins 30, and whilst, the remaining set of openings 26, 27 receive and support an array of longer pins 31. The arrangement is such that on each side of a short pin 30, a long pin 31 is fitted, so that alternate pins are the shorter type.

Three distinct possibilities exist in the way the pins are located within peripheral portion 21, 22, but in all cases, the longitudinal axes of the pins 30, 31 remain fixed relative to the carrier 20.

The pins may be fitted to be either freely rotatable in openings, or fixed in openings. Further, alternate pins may be fixed in their respective openings, and the remaining pins may be freely rotatable in their respective openings. In the case of the pins being fixed in their respective openings, it is preferable that each such pin is provided with a roller positioned between the flange like peripheral portion 21, 22.

Those pins that are fixed in their respective sets of openings may also be used to retain peripheral portion 22 to carrier 20 as an alternative to fitting screws 28.

A geared member 40 with internal teeth 41 is fixed to the housing members 2, 3 of the device 1 by key 23. The pitch circle of the geared member 40 is arranged to be concentric with the axes of both drive shafts 4, 7 of the device 1.

Teeth 41 project inwardly into internal chamber 6 of the device 1 and where a proportion of teeth 41 are sequentially engaged by pins 30, 31 at any one time during the working cycle of the device 1. During one complete gyration of the carrier 20, the carrier 20 indexed by an amount equal to one tooth space.

The long pins 31 are purposely extended at one end 43 to pass

through openings 27 in flange like peripheral portion 21 to engage with respective apertures 45 provided in the locating body 46. Locating body 46 is fixed to flange 29 of output drive shaft 7 by a number of screws 33.

For some applications, it may be advantageous if rollers (not shown) are carried on the ends 43 of pins 31 to engage with their respective apertures 45.

The gear member 40 is provided with at least one more tooth 41 than there are pins 30, 31 so that the device 1 acts as a speed reducer. During operation, the pins 30, 31 (or rollers if fitted) located in the eccentrically mounted carrier 20 engage with teeth 41 of gear member 40 generally through an arc of typically 120 degrees and transfer useful torque through an arc of typically 60 degrees.

In order to balance the internal elements such as carrier 20, the centre of gravity of which is offset from the rotational axis of the drive shafts 4, 7 by the action of the eccentric 15, it becomes necessary in some applications where the input rotational speed is above 1000 rev/min, to include a balance weight 50. In this example, balance weight 50 is shown attached by key 51 to the input shaft 4.

Rotation of the input shaft 4 and integral eccentric portion 15 causes orbital and gyratory motion of carrier 20 (at reduced speed) in the opposite direction due to the pins 30, 31 (and their rollers if such are provided) rolling into and out of sequential engagement with teeth 41 provided on stationary gear member 40. At the same instant, a proportion of the long pins 31 which are in direct engagement with their respective apertures 45

in the locating body 46 operate in translating the gyratory motion of the carrier 20 into rotary motion (at reduced speed) of the output drive shaft 7.

As carrier 20 gyrates about eccentric 15, FIG. 2 shows the relative position of pins 30, 31 as they move towards gradually engagement with teeth 41 in gear member 40. Also shown is the proportion of the long pins 31 that at any one time are in active engagement with their respective apertures 45 in the locating body 46 for translating the gyratory motion of the carrier 20 into rotary motion on the output drive shaft 7.

The second embodiment of the invention as illustrated in FIGS. 3 and 4 differs from the earlier embodiment in that in this example the motion transmitting device includes a male gear member fixed to the output drive shaft.

The device identified by reference number 55 includes a cylindrical housing element 56 attached to a cover housing element 57 to form internal chamber 58. Housing element 56 is provided with two bearings 59, 60 which serve to support the output drive shaft 62. Housing element 57 is provided with bearing 64 to serve as part support for the input drive shaft 65. Input shaft 65 is provided with an eccentric portion 67, and is extended into pocket 69 in the output drive shaft 62, for support by bearing 70.

Bearings 72, 73 are positioned on the eccentric portion 67 of input shaft 65 to rotatably support carrier 75.

Carrier 75 generally comprises two cylindrical portions 76, 77 which are attached to form a single component, and where the cylindrical portion 77 of carrier 75 is formed to include an

inturned flange 79.

The carrier member 75 includes sets of equally spaced pairs of aligned openings 80, 81 and 82, 83. The first set of openings 80, 81 receive and support an array of pins 85, and where pins 85 are purposely extended in length to pass through opening 80 on the left side of carrier member 75. The second set of openings 82, 83 receive and support an array of pins 86, and where pins 86 are purposely extended in length to pass through opening 83 on the right side of carrier member 75. Therefore only alternate pins are extended in the same direction to pass through their respective openings.

Locating bodies 90, 91 are provided to each respective side of carrier 75, and each is fixed to the interior of their respective housings 57, 56.

The first set of pins 85 extend through openings 80 on the left side of carrier member 75 to engage with respective apertures 93 provided in locating body 90. The second set of pins 86 extend through openings 83 on the right side of carrier member 75 to engage with respective apertures 94 provided in locating body 91.

A gear member 95 is rotatably fixed by means of splines 87 to the sleeve portion 88 of output drive shaft 62, and is provided with external male teeth 96 formed on its outer section.

The teeth 96 project outwardly into internal chamber 58 of the device 55 and a proportion of teeth 96 are sequentially engaged by pins 85, 86 at any one time during the working cycle of the device 55.

During one full rotation of the input shaft 65 and the eccentric 67 in one direction, the carrier 75 is caused to gyrate as the

extended ends of pins 85, 86 acting in their respective apertures 93, 94 serve to constrain movement of carrier 75 to a defined path. Therefore, as pins 85, 86 move into and out of sequential engagement with teeth 96 in gear member 95, they transfer a reactive force to the gear member 95, causing it and hence the output shaft 62, to be displaced by one tooth.

The third embodiment differs in one major aspect from the earlier embodiments in that the eccentric member is rotatably supported by a journal bearing in the interior of the housing. The motion transmitting device identified by the reference number 100 in FIG. 5 includes housing elements 101, 102 which are attached together to form internal chamber 105. An input drive shaft 107 is journaled in housing element 101, and an output drive shaft 110 is journalled in bearing 111 such that shafts 107, 110 are coaxial.

Input drive shaft 107 is mechanically engaged by key 112 to disc member 113 with integral eccentric portion 115. The outer surface 116 of eccentric portion 115 is supported for free rotation in the interior of housing element 102 by journal bearing 117, and where the inner surface 119 of eccentric portion 115 acts as a bearing surface to support carrier member 120.

Carrier member 120, being ring like in shape, is provided with a number of equally spaced and aligned openings 123, 124, each opening 123, 124 receiving and supporting a pin 125. Along the inside diameter of the ring like carrier 120, an undercut 127 is provided which intersects the axis of the openings 123, 124 such that the middle portion of the pins 125 is exposed. A male gear means 130 drivingly engaged by key 131 to output shaft 110

therefore sequentially engages with the middle portion of the pins 125 during the gyratory motion of the carrier 120.

Pins 125 are purposely extended at one end 133 through opening 124 in the end face of carrier member 120 to engage into respective apertures 135 provided in a locating body 136 formed in housing element 102.

Rotation of input shaft 107 and eccentric portion 115 of disc member 113 causes carrier 120 to gyrate as the extended ends 133 of pins 125 operate within their respective apertures 135 in the locating body 136. As the extended ends 133 of pins 125 move around their respective apertures 135, the carrier 120 gyrates about the eccentric 115, and pins 125 sequentially engage with teeth 138 on gear means 130, and cause the output shaft 110 to be driven at reduced speed.

The motion transmitting device of FIG. 6 shows a modified form of the invention which is can be used in combination with any of the embodiments already described, and comprises the addition of a conventional gear train disposed between the input drive shaft and the eccentric member of the motion transmitting device.

The advantage of including such a conventional gear train in the device is that the overall reduction ratio of the motion transmitting device can be easily changed by using different numbers of teeth in the gears of the conventional gear train.

As a result, the basic elements of the motion transmitting device can be used to cover a range of speed reducers where the only difference between them is the ratio in the conventional gear train. This allows the manufacturer to tool one set of working parts of the motion transmitting device while still obtaining a

suitable range of ratios for the speed reducers.

The device identified by the reference number 140 includes an input shaft 141 supported by bearings 142, 143 in respective housing elements 144, 145. Gear 146 is drivingly engaged to shaft 141, and is arranged to mesh with gear 147 fixed to sleeve 148. Sleeve 148 is rotatably supported by bearing 149 in housing element 145 and is axially extended to pass into an internal chamber 150 formed when housing element 151 in attached to the end of housing element 145. The sleeve is provided with an integral eccentric portion 154 which is supported on bearings 155, 156 on output shaft 158.

The carrier 160 is supported by bearing 161 on eccentric 154, and is provided with an array of equally spaced and aligned openings 163 into which are fitted pins 164. Pins 164 are extended to pass through their opening 163 to engage an aperture hole 166 provided in locating body 152 formed in housing element 145.

As carrier 160 gyrates about eccentric 154, pins 164 sequentially engage with teeth 167 provided on male gear member 168 which is fixed by key 169 to the output shaft 158.

For certain applications it becomes advantageous that gears 146, 147 are driven by pressurized hydraulic fluid rather than by an input drive shaft 141.

Such a hydraulic gear motor as shown in FIG. 7 comprises two gears 175, 176 located in a housing 145. Gear 175 is keyed to a support shaft 178 and gear 176 being keyed to sleeve 148.

An fluid inlet 180 and a fluid exhaust passage 181 are provided in housing 145 to connect with respective internal chambers 182, 183 serving the gears 175, 176. The action of the incoming

pressurised fluid entering passage 180 acts on the gears 175, 176 in chamber 182 causing the gears 175, 176 to rotate. As gear 176 is engaged to sleeve 148, rotation of gear 176 causes rotation of sleeve 148. The sleeve may be provided with an integral eccentric portion 154 as shown in FIG. 6 to cause carrier 160 to gyrate for operating the motion transmitting device.

Therefore when the machine includes the hydraulic gear motor, shaft 178 supporting gear 175 is not required to pass through to the exterior of the device. As a result, the complete machine when operated by pressurized fluid requires only an output shaft 158 to protrude from housing 140 as is shown in FIG. 6.

Alternatively a pancake electric motor or any other type of electrical motor may be fitted in place of the hydraulic gear motor.

The motion transmitting device of FIG. 8 discloses the location of a male gear means 218 rather than female gear means, fixed to the housing interior of the device, the male gear means being positioned within the carrier member.

The motion transmitting device identified as 190 includes a bearing 207 positioned on eccentric 15 to rotatably support carrier 209. Carrier 209 is provided with a number of equally spaced and aligned openings 210, each opening 210 receiving and supporting a pin 212. Pins 212 are extended on the right-hand end of carrier member 209 to pass out of openings 210 to engage with respective apertures 45 provided in the locating body 46 formed integral with output shaft 7.

Pins 212 are extended on the left-hand side of carrier member 209 to pass out of openings 210 to sequentially engage with teeth 217

provided on the male gear means 218 fixed to a register 219 formed in the interior wall 220 of housing element 2.

Rotation of shaft 4 and eccentric portion 15 causes carrier member 209 to gyrate, and as pins 212 sequentially engage with teeth 217 of stationary male gear means 218, carrier member 209 rotates at reduced speed whilst gyrating. At the same time, a proportion of pins 212 are in engagement with their respective apertures 45 in the locating body 46, and therefore the gyratory motion of carrier member 209 is translated into rotary motion (at reduced speed) on output drive shaft 7.

FIG. 9 discloses a motion transmitting device identified as 230 for use in such applications as a drive wheel of a vehicle, and includes an input shaft 231 supported by bearing 232 in housing element 233 which is engaged to a sleeve 240 by key 242.

Housing element 233 is fixedly located to the machine, for instance, the chassis of a vehicle, to act as a "earth" for the motion transmitting mechanism. Spigot shaft 235 formed integral with housing element 233 supports by bearing 237, the eccentric portion 239 of sleeve 240.

The carrier member 244 is supported on eccentric 239 by bearing 245, and is provided with a number of equally spaced and aligned openings 247, 248. Each pair of openings 247, 248 receive and support a pin 250, and where pins 250 are extended at both ends to pass out through respective openings 247, 248 in carrier member 244 to engage with apertures 252, 253 in respective locating bodies 261, 262 provided in housing element 233.

A wheel mounting surface 256 is provided on which a solid tyre 257 is shown attached, mounting surface 256 being supported on

journal bearings 258, 259 on housing element 233.

Further, on the inside of wheel mounting surface 256, a female gear means 255 is included, the teeth 260 of which are sequentially engaged by pins 250 during the gyratory motion of the carrier member 244.

Rotation of shaft 231 and eccentric 239 causes carrier member 244 to gyrate as the pins 250 engaging in apertures 252, 253 constrain the carrier 244 to move in gyratory fashion about eccentric 239.

As pins 250 sequentially engage with teeth 260 provided on gear 255 formed on wheel mounting member 256, the gyratory motion of carrier 244 is translated into rotary motion (at reduced speed) of the wheel mounting member 256.

A modified form of the invention applicable to all the embodiments described above, would be to arrange that the eccentric member is rotatably supported on the output drive shaft, the eccentric member being rotatably driven by the input drive shaft by suitable driving means such as driving dogs.

The speed reducer as described in any of the embodiments may also function as a speed multiplier by reversing the described input and output shafts.

It is to be understood that while we have illustrated and described embodiments of the invention, it is not to be limited to the specific form or arrangement of parts herein described and shown except insofar as such limitations are included in the claims.

CLAIMS

1. A motion transmitting device comprising gear means, a carrier having a generally circular array of longitudinal pins mounted thereon such that their axes are fixed with respect to the carrier, the gear means and the carrier being constructed and disposed relative to each other such that relative gyratory movement transverse to the pin axes causes the pins and the gear means to engage and disengage to cause relative rotation of the carrier or gear means, and means for coupling an output shaft to the gear means or pin carrier for rotation of the shaft in response to the relative rotation of the carrier or gear means, wherein at least some of the pins extend beyond the carrier and wherein the device further comprises a locating body having apertures for respectively receiving extending portions of the pins and for engaging the portions whilst not restricting the gyratory movement thereof.

2. A device as claimed in Claim 1 wherein alternate extending pins extend in opposite directions and there is a locating body for each set of pins.

3. A device as claimed in Claim 1 wherein the locating body constitutes the coupling means and is rotatable with the output shaft.

4. A device as claimed in Claim 1 or Claim 2 wherein the locating body is fixed and the coupling means includes or is constituted by the gear means.

5. A device as claimed in Claim 4 wherein the gear means is mounted on the output shaft and is surrounded by the

pins.

6. A device as claimed in Claim 5 wherein the pin carrier is cut away or overhangs to expose the pins to the gear means.

7. A device as claimed in any one of the preceding Claims wherein the gyratory means includes an input shaft and an eccentric mounted on the shaft.

8. A device as claimed in Claim 7 wherein the carrier is relatively rotatably mounted on the eccentric.

9. A device as claimed in Claim 7 or Claim 8 wherein one of the input and output shafts is hollow and the other is rotatably supported therein.

10. A device as claimed in any one of the preceding Claims including an input gear train for driving the gyratory means.

11. A device as claimed in Claim 10 wherein the gear train is part of a hydraulic gear motor.

12. A device as claimed in any one of the preceding Claims wherein the pins or parts thereof are rotatably about their fixed axes.

13. A device as claimed in any one of the preceding Claims wherein the pins carry a roller element.

14. A speed reducer including a device as claimed in any one of the preceding Claims.

15. A motion transmitting device of Claim 1 wherein a single array of longitudinal pins is disposed within said carrier, said array of pins being disposed in a circular fashion on a pitch circle of constant value, and where said gear means is

positioned within said pitch circle and fixedly located to the housing interior.

16. A motion transmitting device of Claim 1 wherein said carrier is comprising of at least two elements, and where at least one of said pins acts to hold said elements of said carrier together.

17. A motion transmitting device of Claim 1 wherein said carrier is supported within an eccentric member, said eccentric member being driven by an input drive shaft and supported within a bearing member disposed in the housing.

18. A motion transmitting device of Claim 11 wherein the housing includes an opening for the output drive shaft and at least two fluid conduits for receiving and expelling hydraulic fluid for the gear motor.

19. A motion transmitting device of Claim 1 wherein said gear means is fixedly located to a wheel supporting surface.

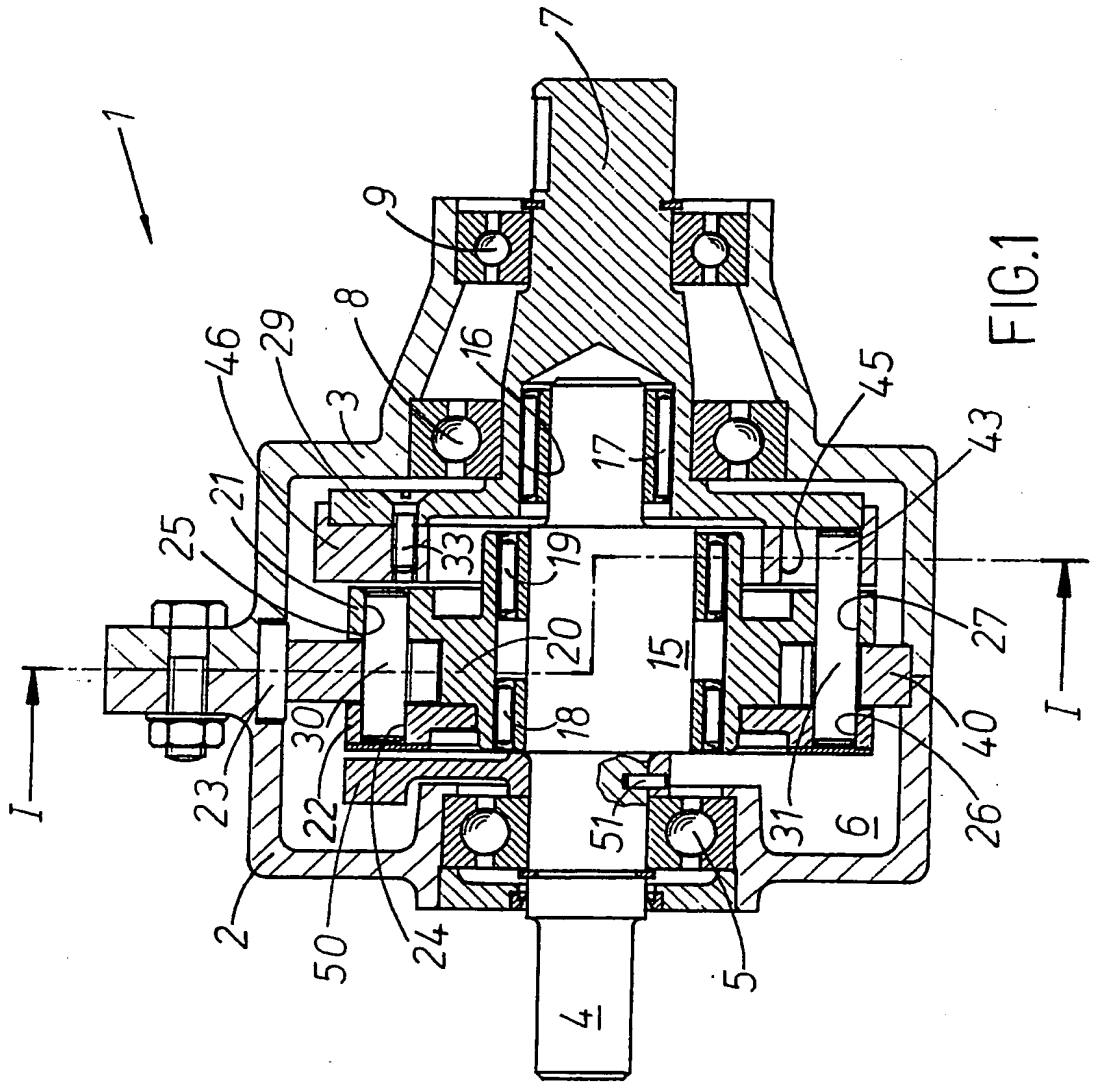
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FIG.1

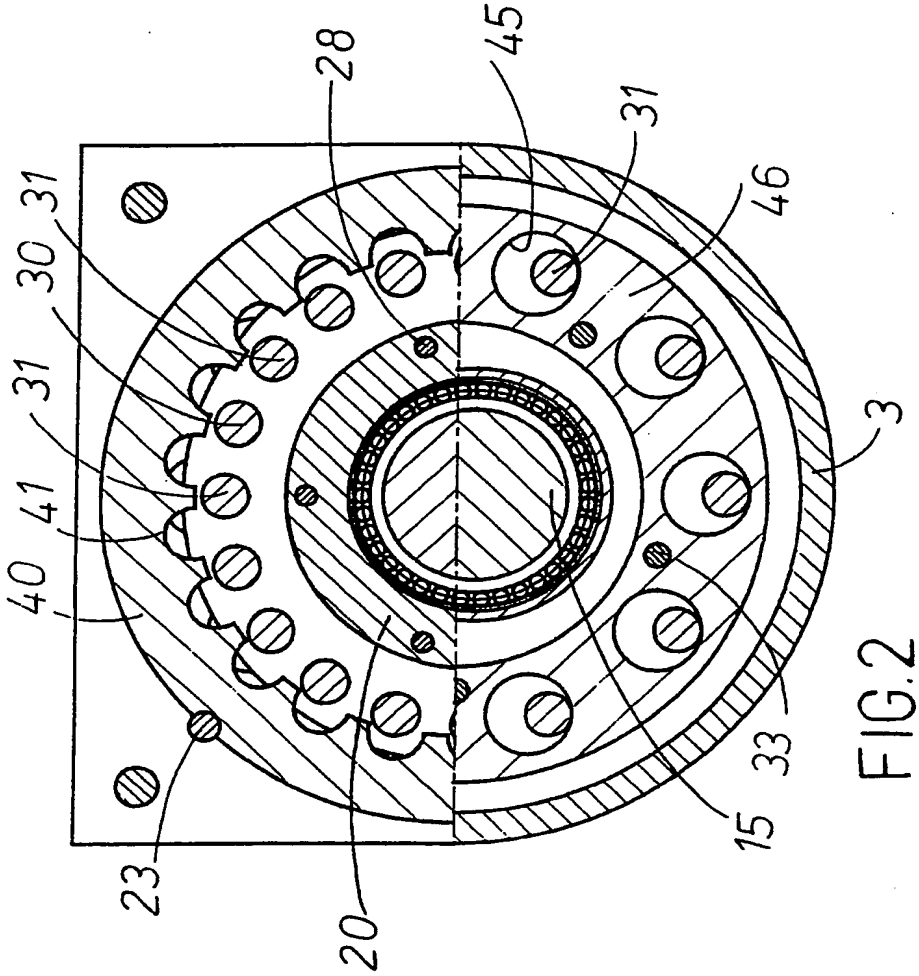

FIG.2

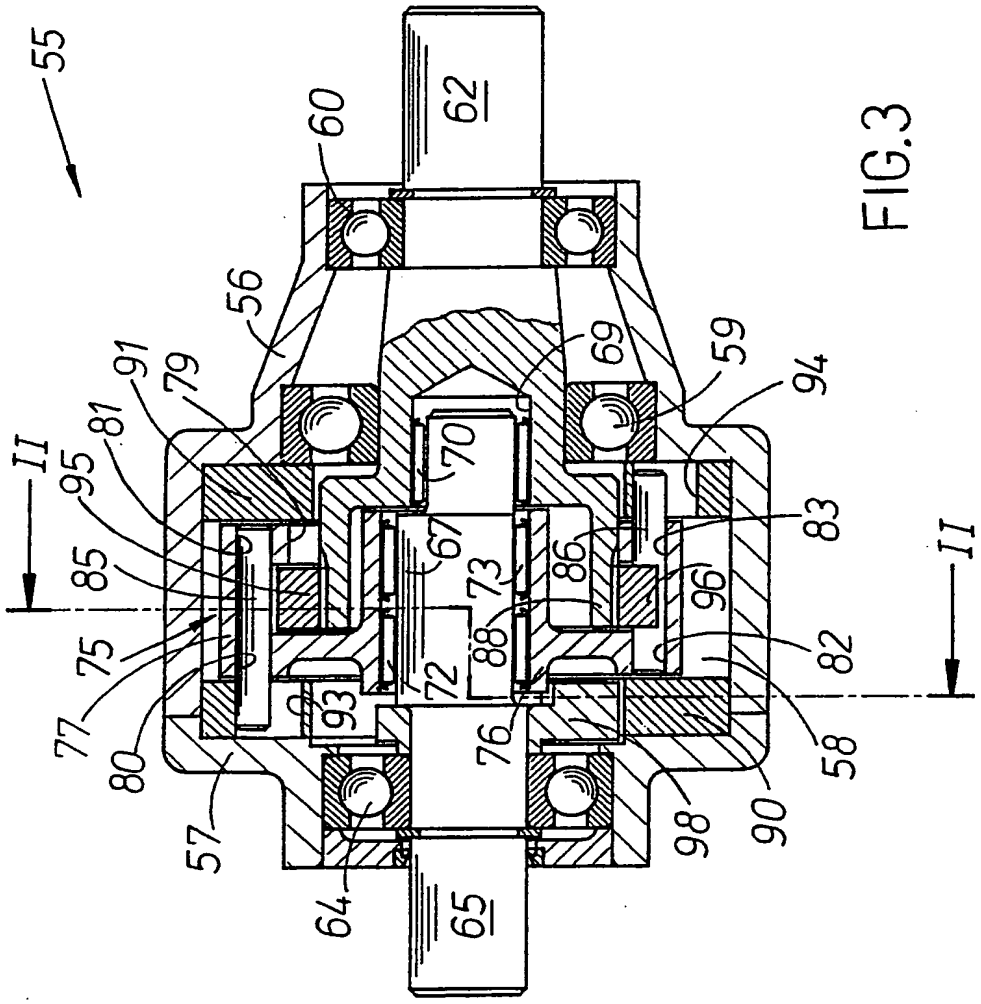
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FIG.3

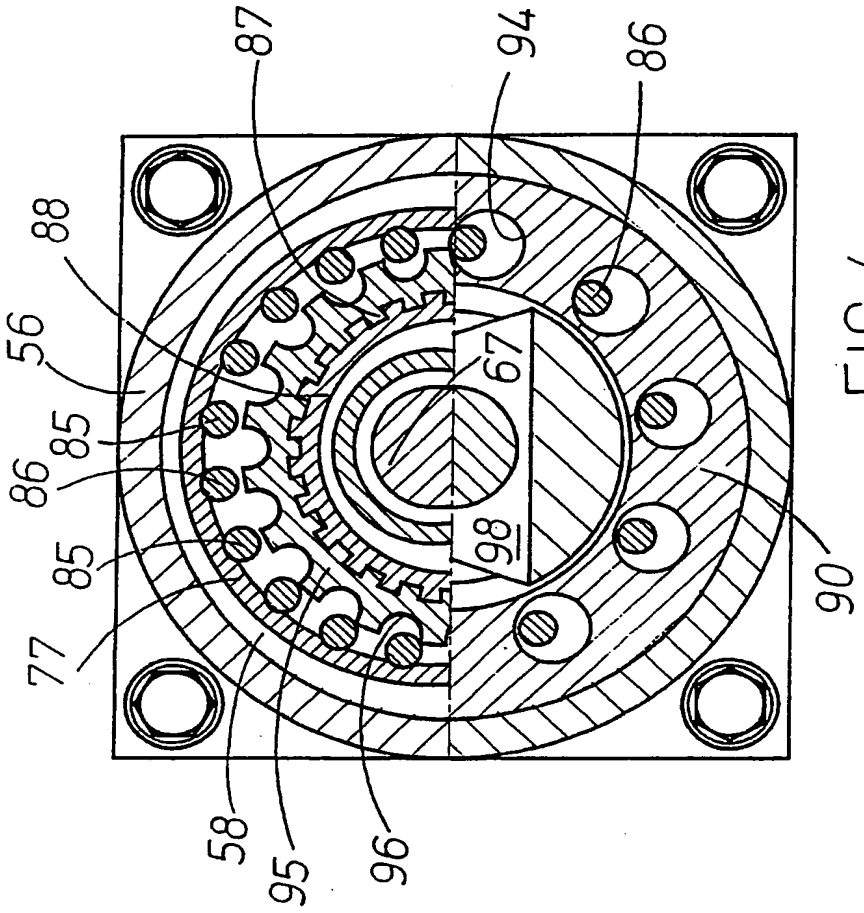

FIG. 4

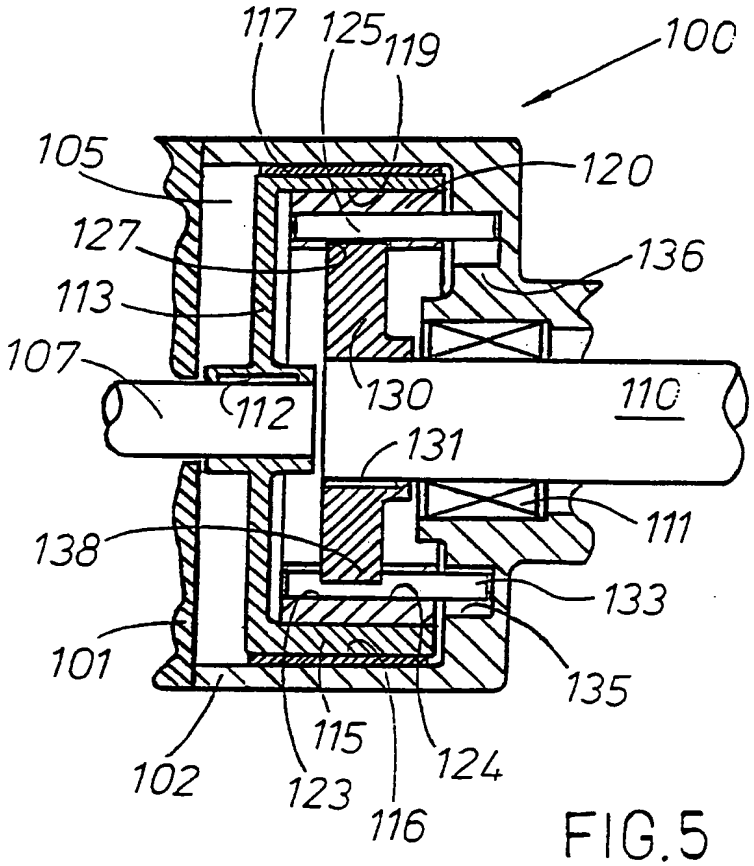
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FIG.5

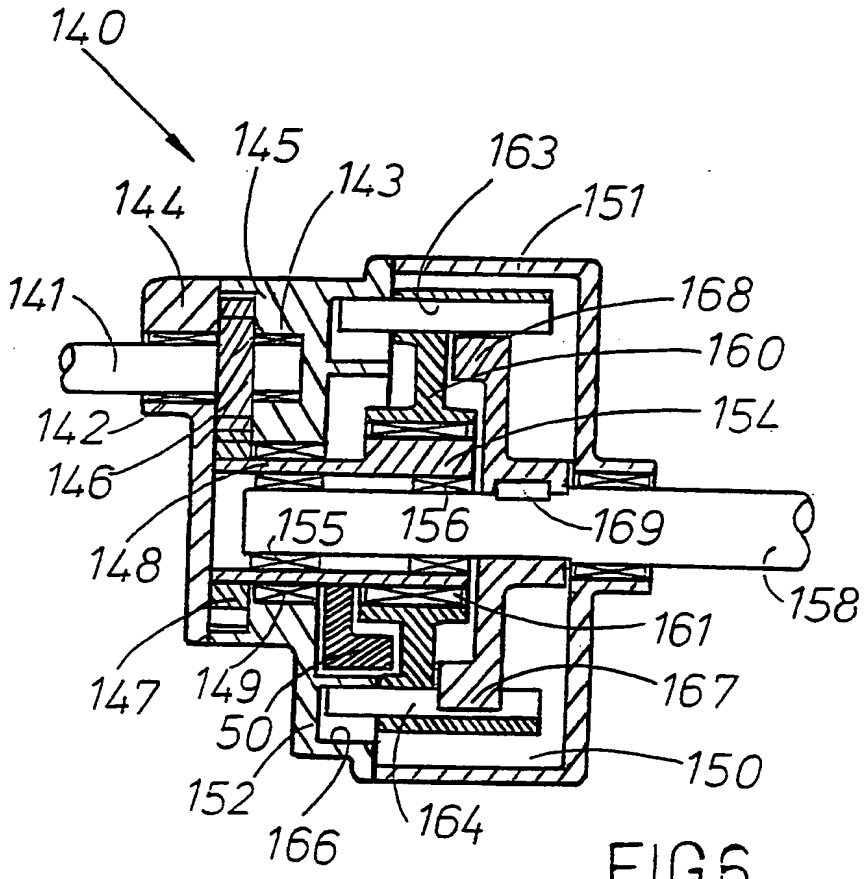
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FIG.6

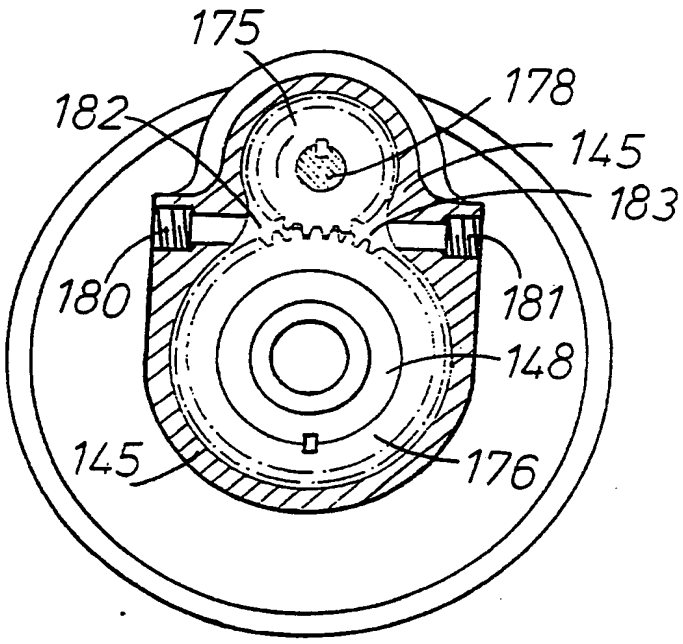

FIG.7

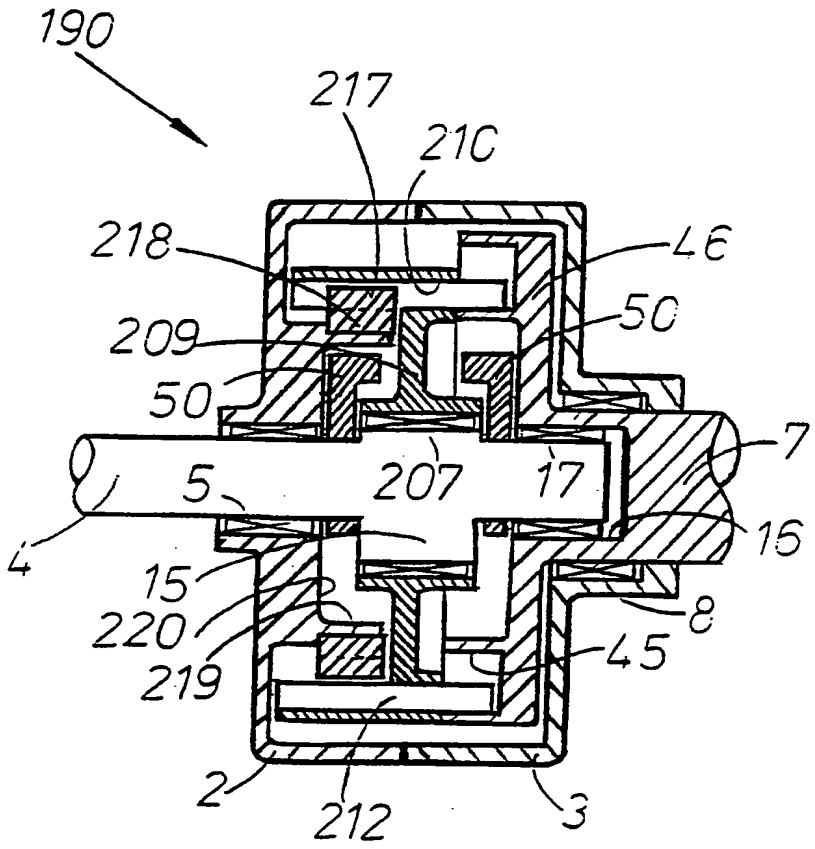

FIG.8

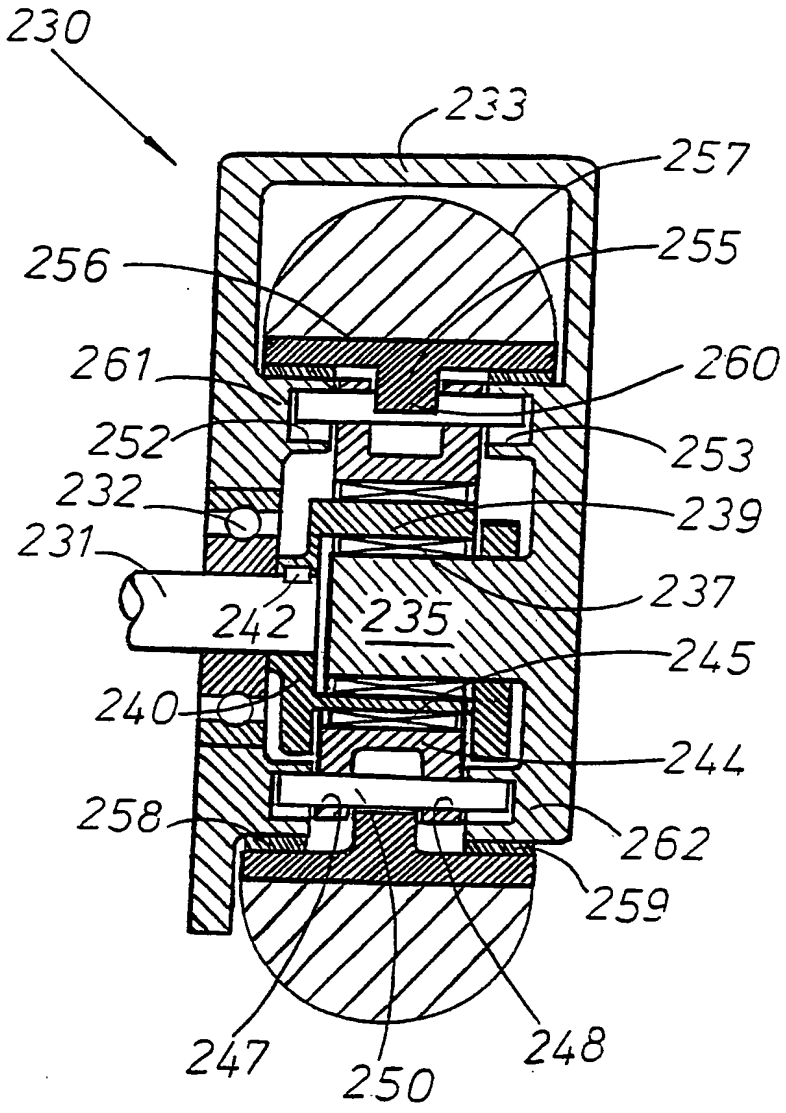
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FIG.9

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 91/01194

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 F16H1/32

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	F16H

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
X	DE,A,3 418 686 (BRAREN R) October 3, 1985	1,3-9, 12,14,17
Y	see the whole document	10,13,15
A		18
X	US,A,1 773 568 (BRAREN L) June 13, 1927	1,3-9, 12-14
A	see the whole document	15
Y	EP,A,75 667 (ELEKTRO-MECHANIK) April 6, 1983	10
A	see page 5, line 16 - line 26; figure 1	1
Y	DE,A,3 816 756 (SHI) November 30, 1989	13,15
A	see column 3, line 65 - column 4, line 5; figures 13-15	1,3,7-9, 12,14

[10] Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
09 OCTOBER 1991	24 OCT 1991
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	FLODSTROEM J.B.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

GB 9101194
SA 49504

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

15/10/91

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A-3418686	03-10-85	None	
US-A-1773568		None	
EP-A-75667	06-04-83	DE-A- 3138004 JP-A- 58131455 US-A- 4484496	21-04-83 05-08-83 27-11-84
DE-A-3816756	30-11-89	None	